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SOIL WORK DURING 1913.

By M. Barrowcliff.

In this article there is given a brief account of the nature and extent of the soil and allied work carried out by the writer during the past year.

In all 121 samples were accepted for full analysis, of which 100 were collected, the remainder, mostly from distant localities, being received from managers of estates.

The field work involved occupied 9 weeks, taken up mainly by the visits to Gunong Tahan and the localities of the proposed irrigation schemes mentioned below.

The soils dealt with may be classified under the following headings :—

	No. of Samples	
	Total	Reported upon
Rubber	27	27
Coconut	33	21
Padi	51	33
Mountain	10	9
	121	90

Of those unfinished at the close of the year all were collected or received during December.

The determinations now being included in the analysis comprise sand, silt, fine silt, clay and humus, moisture, organic matter, potash, phosphate, lime, magnesia, nitrogen, "available" potash, and "available" phosphate.

Progress was at first slow, but during the second half of the year, after improved methods had been tested and a Malay assistant trained to render effective help, became greatly accelerated.

This year it should be possible, even if the hoped-for assistance of another Europeon assistant chemist is not forthcoming, to deal with from 150 to 250 samples, according to the time occupied by field work, which at present necessarily involves stoppage of the laboratory operations.

Rubber Soils :—Of these all were for estates requiring advice as to the arranging of manurial trials or the treatment of backward or deteriorating areas. The heavy fall in the price of rubber has caused a set back to the employment of fertilisers but it is anticipated that this will be only temporary, and that this branch of the soil work will become of considerable importance.

An extensive series of manurial experiments have been started on the Castleton Estate, Telok Anson, in conjunction with Mr. F. G. Spring. They have been planned to ascertain the effect of lime, nitrogen, potash, and phosphate in all combinations and to test also the difference due to applying them in the various forms in which they are purchasable, as for instance burnt lime against limestone, basic slag against superphosphate.

Each plot is of 2 acres, composed of trees of uniform age and girth. Results will in the first year be expressed in terms of increase of girth, later as yields of rubber.

The experiments as established are to be permanent, the manures being renewed every 2 years in order that ultimate effects, renewal of bark, quality of rubber, etc., may be observed.

Coconut Soils :—An investigation has been commenced on the soil conditions governing the fertility of the coconut tree.

Whereas rubber grows well and affords satisfactory yields on almost any class of soil in which it is planted the coconut tree is much more fastidious. In some places a yield of 20 nuts per tree each year may be taken as the average, in others it reaches 80 or even 100.

Increasing attention is certain to be paid to this cultivation in the near future and any obtainable information which will enable a valuation to be made of the probable quality for this purpose of a given soil cannot fail to be of value to intending cultivators. It is hoped that from the investigation there will also be acquired some knowledge of the manurial and cultural treatment of coconut plantations most likely to prove effective in increasing the output.

Work at present is being confined to districts of noted fertility and will subsequently be extended to others in which the yields are low. The Bagan Datoh soils have been investigated, analyses have been made of a number received from the East Coast, and others from the Batu Gajah and Kuala Kangsar districts are now being dealt with.

Padi soils :—The results of a number of analyses of padi soils and the conclusions derived therefrom were given in the July number of this *Bulletin* and need not be recapitulated. Manurial experiments based on them have been initiated and are being carried out this year in the Rembau and Kuala Pilah districts of Negri Sembilan.

In connection with the various schemes for irrigating padi lands being undertaken by Government soil surveys are being carried out and reports furnished. Two such have been completed, dealing with small schemes at Pulau Tawar and Dong, both in Pahang; in the case of a third, at Laiang-Laiang, Perak, comprising 16,000 acres, the field work has been completed and the laboratory work is now in progress.

Mountain soils :—In September a visit was paid to Gunong Tahan, the site of the proposed hill station, for the purpose of ascertaining whether land suitable for cultivation was to be found at high altitudes. The result was disappointing, for although there is, at a height of 4,500 feet and over, a very large area, probably 3 square miles, that is covered with a characteristic jungle growth and might therefore be expected to be of value, it is established on a soil almosf entirely composed of peat and therefore unsuitable for cultivated crops. Below this peat, at no great depth, is sandstone rock so that potentiality for improvement does not exist. At 5,000 feet the peaty layer is still shallower and supports only a scrubby vegetation and at higher altitudes, 6,000-7,000 ft., the sandstone is covered by only a few inches of loose soil.

Although as stated the great bulk of the land is unsuitable for cultivation several small areas were found, characterised by jungle of a much heavier type, in which a more normal soil has accumulated. It will be possible, it is thought, to utilise these for such purposes as vegetable and perhaps fruit growing on a small scale.

Future Work :—Even with the present organisation it is expected that estate and Government work called for during 1914 will be comfortably dealt with and opportunity remain for other investigations. Of these the first to be carried to completion will be that on coconut soils dealt with above.

The knowledge that will by then have been acquired of the types of soil best suited for the staple cultivations of the country will justify the commencement of survey work of the agricultural possibilities of the districts now being opened up by railway and road development, in the belief that it will be possible thereby to afford to possessors of capital reliable information as to where, in planting pursuits, it may be most profitably employed.

Expression is still frequently heard of the opinion that soil analysis is of little, if any, utility in determining the value of a soil

or the nature of its manurial requirements. This opinion is usually found to be based on experience derived before modern methods of determining the relative proportions of clay, silts, and sand, which afford an invaluable indication of the moisture holding capacity, porosity, etc., were introduced into analytical practice. To it the reply can be made that no other methods than that of considering the data afforded by the chemical and mechanical analyses exists for applying to the unknown a knowledge of the known.

The causes of niceties of difference may not indeed be always ascertainable, but broader distinctions, such as should induce a planter to experiment on methods of improvement, can with certainty be recognized and explained.

The power of predicting that a certain course of treatment will assuredly prove profitable is *not* claimed, but there can be indicated the lines on which success is most likely to lie, and if only the waste of money involved in adopting extravagant programmes on the strength of reputed success elsewhere, perhaps in another country, can be checked, appreciable advance will have been made.

PRICKING OR TAPPING.

By F. G. Spring.

For the purpose of making a comparison of these two systems one hundred 4-year-old rubber trees of approximately equal girth were selected, 50 trees being tapped with the serrated knife and the other 50 with the gouge. The trees tapped with the gouge were marked out on the single quarter system (half herring bone) with two cuts 18 inches apart and tapping was conducted every day at the rate of approximately 20 cuts to the inch. The Northway 4-Point Serrated Knife was used in the other area and tapping conducted on the single quarter system. The following directions for the use of the serrated knife were adopted and are taken from a circular issued by the agents. "The trees may be tapped on the half or full herring bone" principle. The following describes the half "herring bone" system :— A narrow vertical channel is cut in the tree upto a height of 5 feet or more (according to age and size) from its base for carrying the latex. The "Northway Gouge" knife, or any other paring knife, may be conveniently used for this. A space about 1½ inches wide on one side of the channel is then scraped to remove dry bark or other inequalities of surface.

"The knife is then pressed into the tree at either the top or bottom of the vertical channel, and at an angle of about 45 degrees to it, and punctures made one foot apart, thus dividing up the tree into sections of a foot each, in each of which one puncture is made

daily See that a clean puncture is made by inserting and removing the blade sharply without lateral play. After each puncture the exuding latex should be at once guided into the vertical channel (a small twig may be used for this), after which it will continue to flow naturally. Subsequent daily punctures are made ½ inch below the last in each section. This is continued till the sections are finished, a matter of 24 days' tapping, when the whole operation is repeated on the opposite side of the tree. When four such complete sections have been tapped opposite one another, the spaces between are operated upon till the tree is finished, when it will be found that the first portion tapped is ready to be done again. If it is not, the tree may be rested for a few months. Each puncture being only 1½ inches long as opposed to the continuous cut of existing paring systems, and there being no bark removal, the flow of sap is very little interfered with, and the recuperative power of the tree greatly assisted. The result is a healthy tree which continues to improve in yield.

"The serrated blade is that which makes the incisions to bottom of latex cells; the bevel edge is for the purpose of making a very shallow cut or indent in the bark in order to induce the latex to run into central vertical channel. The latter blade should be adjusted to the desired or necessary cutting depth and then the blunt guard on opposite side adjusted."

The trees experimented with in Kuala Lumpur Government Plantation were tapped according to above on the single quarter system with five punctures one foot apart dividing the tree into sections of one foot each. In both experiments tapping was conducted each day.

The following are the results obtained over a period of five months:—

	Serrated Knife.		Gouge.		
	Latex Rubber.	Scrap.	Latex. Rubber.	Scrap.	Bark Shaving.
7th June to 6th July, 1912	2 lb. 11½ oz.	1 lb. 6 oz.	2 lb. 8 oz.	1 lb. 3½ oz.	...
7th July to 6th Aug. ,,	4 ,, 1½ ,,	1 ,, 15 ,,	5 ,, 3½ ,,	1 ,, 11½ ,,	...
7th Aug. to 6th Sept. ,,	6 ,, 11 ,,	1 ,, 10 ,,	4 ,, 8½ ,,	1 ,, 8 ,,	...
7th Sept. to 6th Oct. ,,	6 ,, 2 ,,	1 ,, 4½ ,,	5 ,, 5 ,,	1 ,, 9½ ,,	...
7th Oct. to 6th Nov. ,,	6 ,, 1½ ,,	1 ,, 9 ,,	7 ,, 10½ ,,	1 ,, 6 ,,	...
Total ...	25 lb. 11½ oz	7 lb. 12½ oz.	25 lb. 3½ oz.	7 lb. 6½ oz.	1 lb. 12 oz.

Total Rubber—Serrated Knife = 33 lbs. 8 ozs.
Total Rubber—Gouge = 34 ,, 6 ,,

As far as yield is concerned there is practically no difference in the two systems over a period of the first five months tapping. As the girth of the trees increases there will be a corresponding increase in the length of the cuts where gouge tapping is conducted and a consequent increase in yield in this system, but in the other plot the same increase in yield can hardly be expected as the size of the cuts always remain the same, and if the number of cuts be increased as the tree becomes older, to more than five one foot sections, tapping becomes more difficult and expensive. The next point to be considered is cost of labour in the two areas. I find that when using the Northway Serrated Knife the cost of Labour is about double that where the gouge is used, an important point on an estate. The time lost in using the serrated knife I found due to the following:—

1. Placing the knife at the correct angle in five separate sections.
2. Guiding the latex.
3. Collecting scrap.

After the period of five months' tapping the trees were left untapped for one year and then closely examined. As regards the health of the tree in the case of the gouge it is unnecessary to deal, as it is well known that renewal of bark depends largely on the quality of tapping. In the case of the serrated knife no injury to the tree could be found.

PRODUCTION OF PAPER PULP FROM GRASSES.

REVIEW BY B. J. EATON.

In view of the installation of an experimental paper pulp plant at the Agricultural Department and information published recently on the production of paper pulp from one of the wild ginger plants, *Hedychium coronarium*, and previously on lallang grass, in this country, for the same purpose, the following abstract of an instructive pamphlet written by Mr. W. Raitt—Cellulose Expert attached to the Forest Research Institute Dehra Dun—should prove of interest. The pamphlet in question deals with the Savannah grasses of India and treats very fully of their value as raw materials for paper pulp.

As is probably well known, wood pulp has replaced superior materials such as linen and rags, esparto and other grasses especially for the cheaper qualities of paper, newspapers, etc., and has assumed large proportions, particularly in Europeon countries such as Norway and Sweden, and in Canada.

The successful production of wood pulp depends on cheap transport and labour, suitable woods and cheap power such as water power, since a comparatively large amount of power is consumed in grinding the materials. It would seem doubtful whether the condi-

tions in this country are suitable, in respect of these factors, for the manufacture of wood pulp for paper making.

On the other hand, one grass in particular, *Imperata acundinacea*, commonly known as lallang, is ubiquitous and its utilisation as a raw material for paper making has been considered and its manufacture on a small scale is being carried on at present I believe, in this country.

Great interest was taken about a year ago in another plant, *Hedychium coronarium*, a species of wild ginger, known to exist in large quantities in South America and which it was thought might be introduced successfully into this country or possibly be indigenous. Species of wild gingers are now being cultivated at the Experimental Plantation, Kuala Lumpur, with a view to the experimental manufacture of paper pulp shortly. One of the principal factors required in this connection is a large quantity of raw material.

The highest qualities of paper are manufactured from rags, waste linen, etc., secondly from exported cereal straws and one or two other grasses such as Baib, (*Ischaemum angustifolium* in India, and finally the lower grades from wood pulp.

Among the grasses, (Gramineae,) is included Bamboo, which will probably be found of value for this purpose, but is not included among the ordinary grasses which have only slightly lignified culms since Bamboo requires special digestion for purification and extraction of cellulose. Bamboo in this country may prove to be a useful raw material for the manufacture of paper pulp. The writer of the pamphlet referred to, shows that the following factors are important, in connection with the utilisation of grasses for the manufacture of paper pulp:—

(1) Associated growth—in which two or more grasses are growing together, so that satisfactory separation is impossible, but similar digestion and bleaching treatment can be given to each, and the different species treated as one.

(2) Mixed growth—in which the grasses exist near each other in separate clumps, necessitating more time in collection, when only one grass is suitable, or tending to increase the danger of a dishonest or ignorant coolie collecting the unsuitable as well as the suitable species.

(3) Weed growth—*i.e.*, mixtures of grasses occurring together in the same clump so that separation of unsuitable species necessitates hand-picking and becomes very expensive.

The pulp manufacturer has to adopt a treatment in respect of digestion and bleaching, which is most suitable for the most predominant species in order to obtain a suitable pulp consisting of practically pure cellulose, and if quantities of very resistant species are

present there will be considerable loss by hydrolysis of the more easily reducible material.

Modern methods of extraction of the pulp have enabled mixtures containing small quantities of resistant species to be separated satisfactorily after reduction to pulp.

The author has, on this account, divided the Savannah grasses of India into two main divisions, (1) those of major importance because of the quantities available and their predominance in their respective areas; (2) those of minor importance in respect to quantity, but found mixed or associated with the important species.

The grasses of major importance are as follows:—

Saccharum spontaneum.	Anthistiria gigantea.
,, arundinaceum.	(s.s. Villosa).
,, munja.	Imperata arundinacea.
,, parenga.	Eragrostis cynosuroides.
Arundo donax	Phragmites karka.

Anthistiria gigantea (s.s. Arundinacea).

The only one of these which exists in large quantities in this country is Imperata arundinacea (lallang) although the large swamp grasses found sometimes on large areas here, may be among the above.

The following reasons are given for the consideration of these grasses as possible or probable raw materials:—

(1). The demand for grass pulp and other forms of cellulose is in excess of the supply and nothing further can be expected of materials already in use.

(2). The improvement of modern methods of extraction and recovery of chemicals used in digestion, etc.

(3). Improved methods for extracting unreduced materials mechanically from pulp.

(4). The development of the industry, which now consists essentially of two distinct branches (1) pulp making (2) paper making: The first is now carried on near the source of raw material, thus saving transport of useless material, while the latter is carried on nearer the distribution area of the final product.

The stage in the growth of the various grasses, at which the tbest results are obtained, is shewn to be prior to or during the flowering stage, since while the seed is maturing, considerable lignification akes place, and this causes loss of cellulose, owing to the more severe digestion required to reduce lignified material.

This again has an important bearing on crop, since if the seed is unable to ripen and germinate, the plant has to reproduce vegetatively and the tendencyis to weaken the plant and reduce subsequent crops. With this factor in view the writer recommends a larger area than that actually necessary for the amount of pulp required, to enable the plant to seed. Thus for a grass which seeds annually,

double the area necessary to produce a requisite quantity of pulp, should be taken, to ensure a two year rotation or cropping.

Interesting figures are given shewing the cellulose contents of the different grasses, and the yields obtained after digestion and bleaching, which do not necessarily bear a direct relation to each other.

Thus, while *Anthistiria gigantea* has a cellulose content of 50.7% and yields 39% of bleached pulp, *Imperata arundinacea* which has a cellulose content of over 54% only yields 35% of bleached pulp. The most suitable temperatures and pressures for digestion and period of digestion required are given in each case, with the yields obtained, and remarks on the quality of the final product.

General Conclusions :—

From the results obtained it is concluded that out of 10 species of major importance and 8 species of minor importance, two of the former and three of the latter are of doubtful value owing to inferior quality or unsuitable because they do not yield clean pulps under the standard conditions applicable to the majority of the grasses of major importance. These species are therefore unsuitable as mixtures.

It is disappointing however to find *Imperata arundinacea* (lallang) included in this list as inferior, especially since in this country, as in India, it would certainly be a grass of major importance in respect to quantity available and predominance over large areas.

This inferiority is due principally to weakness and shortness of fibre and difficulty of bleaching. Since lallang grass as a raw material for the production of paper pulp has been favourably reported on in this country, it may possess different qualities, depending on soil, moisture conditions, etc.

A sample of normal-air-dried lallang, containing 11.6% of moisture, prepared in this country, was found by the writer of this review to contain 57.1% of cellulose, which is higher than that given for the Indian material. The material examined by me had undergone preliminary treatment. Suggestions for improving the methods of extraction by first crushing the more resistant nodes of the grasses between rollers and economising soda by preliminary treatment of the material in water to remove starch and other soluble constituents, which increase the soda consumption, are also given. Finally, the cost per ton of unbleached pulp at the factory is estimated in each case, although certain items of expenditure are uncertain.

The order in which the grasses of major importance are placed as regards commercial value is as follows :—

(1). Anthistiria gigantea sub-sp. arundinacea.
(2). „ „ „ „ villosa,
(3), Saccharum munja,

(4). Ischaemum angustifolium.
(5). Phragmites karka.
(6). Saccharum arundinaceum.
(7). ,, parenga.
(8). ,, spontaneum.
(9). Arundo donax.

It will seen that Baib (Ischaemum angustifolium) which is already used commercially takes fourth place on this list.

The figures given shew that the cost of production is less than the delivered cost of European wood pulp imported into India to make up for the shortage of Baib.

An instructive preface is written to the pamphlet by Mr. R. S. Hole, Botanist at the Forest Research Institute Dehra Dun, dealing with the growth of the different grasses, flowering periods and probable crops, together with the rotation necessary to allow seeding to take place. One species, *Saccharum arundinaceum* appears to be outstanding with regard to yield, as it produces 44.3 tons of dry grass per acre in one cutting or an estimated annual yield of 14.8 tons, calculated on a suggested 3 year rotation.

It is interesting to compare this yield with that of *Hedychium Coronarium* which is 6-10 tons of dry material per acre, and which is said to be greater than that of any other product for paper pulp; this latter is thus seen to be considerably less than the grass. This large yield is however due to the habit and growth of the plant, as this species attains a height of 25 feet and the culms have a diameter of $\frac{3}{4}$ inch, thus resembling sugar-canes or bamboos in its general growth.

PROGRESS REPORT ON LOCUST WORK TO NOVEMBER 30th, 1913.

Federated Malay States.

So far as can be ascertained, locusts are still confined in the Federated Malay States to the States of Selangor and Negri Sembilan. Rumours of swarms having reached Perak have so far proved to be without foundation. The most Northerly limit of distribution at the end of the month is Kuala Kubu. Southward the locusts extend in a series of areas which roughly follow the main road from Kuala Kubu through Kuala Lumpur and Kajang to Seremban and Tampin. Many swarms of hoppers have been reported from Malacca territory. The Southern limit of distribution in the Peninsula cannot be ascertained. The most Easterly record is for Ayer Kuning in the South-east corner of Negri Sembilan.

No locusts have yet been reported from Pahang. There is, however, the possibility of swarms of flying locusts having crossed unobserved from Selangor; swarms also which have been lost sight of while flying Eastwards from Kuala Pilah in Negri Sembilan may have reached Pahang, where they may easily have bred unobserved.

It will thus be seen that since the previous generation, when fliers were observed as far North as Tanjong Malim, and when eggs were laid at Rasah, there has been no Northerly advance. This is a matter of the utmost importance in view of the large areas under padi in Perak, Province Wellesley, and Kedah, especially as it has recently been demonstrated in Negri Sembilan that locust eggs will hatch quite readily in the wet mud of the padi fields provided there is no standing water on the sawahs.

Selangor.

There have been no hoppers in Selangor during November. The attention of the Special Assistant and of the locust staff has been directed to keeping watch on all the swarms of fliers in the State. The number of swarms decreased from the beginning of the month onwards. The reason for this, doubtless, is that swarms joined forces. This conclusion is supported by the fact that the number of small swarms decreased and the big swarms became more numerous. There are now under observation twenty swarms, of which six are small, three larger, and eleven big. They are distributed as follows:—

Kuala Kubu and Serendah	4	swarms
Rawang	3	,,
Kuala Lumpur	4	,,
Setapak and Ulu Klang	2	,,
Ulu Langat	7	,,

Egg laying is expected to commence shortly, and a careful watch is being kept on the swarms to endeavour to locate the breeding grounds.

Negri Sembilan.

From the appended summaries of the number of swarms destroyed, and tins of hoppers caught in Negri Sembilan during October and November, it will be seen that the swarms there were very numerous, and individually small. An immense amount of labour and the spending of much time was thereby entailed in transporting apparatus. The difficulties of the work greatly increased by the inaccessibility of many of the swarms, some being many miles from road or railway.

The periodicity which is so marked a feature in the alternation of fliers and hoppers in Selangor is not so marked in Negri Sembilan. The generations have been overlapping in the Coast District for the

last three months, both hoppers and fliers being present in the district throughout the whole of the time. This overlapping of generations appears to be extending to Tampin District and slightly to Seremban where eggs have been hatching throughout a period of nearly two months, and reports of first instar hoppers were still being received.

The distribution of the locusts has altered somewhat since the previous generation, when Seremban, Pantai, Sungei Gadut, Siliau and Port Dickson, Rembau, and Tampin were the six areas in which locusts were numerous. Of these areas, Seremban, Pantai, and Tampin have been free from hoppers during the present generation, the present distribution being:—

Seremban District.	Lengging and Broga.
	Mambau and Rantau.
Coast District.	Throughout.
Tampin District.	Kampong Batu and Lubok China.
	Keru and Tebong.
Kuala Pilah District.	Gemenchi.
	Jelei.

The known area of distribution is thus very wide, and efficient supervision could, therefore, not be carried out by the three Special Assistants appointed to Negri Sembilan. Fortunately the coincidence of the flying stage in Selangor with the hopping stage in Negri Sembilan set free one of the Special Assistants for Selangor to assist in the field work in Negri Sembilan.

Labour has not always been easy to obtain. Much of the work has been done by Malay coolies, but as the padi harvest was in full swing in some districts the Malays were often unwilling to work in the locust gangs. The co-operation of the District Officers greatly assisted in overcoming this difficulty. After the harvest no trouble is anticipated in obtaining labour as the Malays are quite awake to the necessity of destroying the locusts.

Most of the locusts destroyed have been dealt with by the sheeting and bag-trap method described in the *Agricultural Bulletin* for October. This method is not, however, applicable to swarms in padi, as driving across the wet sawahs is almost impossible. Instead, small quantities of crude oil or kerosene were poured on the water in the flooded sawahs, and the hoppers shaken off the padi into the oil by means of long bamboos. Immersion in water has little or no effect upon the hoppers, but when a thin film of oil is added, the locusts which fall in are quickly killed. By this method many swarms were wiped out which could not otherwise have been dealt with. The method commends itself to the Malays as it destroys at the expense of very little exertion those locusts which are

obviously doing them injury. The work is light, and can easily be done by the women and children.

The above method was first suggested and tried by the Government Entomologist.

A large number of breeding grounds was reported from Malay kabuns and from estates. Many of these breeding grounds were changkolled to a depth of four or five inches, and the soil broken up to expose the eggs. Owing to unpropitious weather conditions the value of the method could not be determined. Heavy rain after changkolling covered the majority of the eggs with wet earth, thus undoing the work that had just been done.

At Rantau a big swarm chose the padi fields for their egg-laying ground. At the time there was no free water on the sawahs but the mud was quite wet and soft. The eggs were laid in enormous numbers over many acres, there being in places as many as ten egg-holes to the square inch. Development appeared to proceed normally notwithstanding the wet environment. Just as the hoppers were beginning to emerge, heavy rain fell, the padi was flooded, and the majority of the young locusts were drowned in the egg. Wherever it is possible to flood a breeding ground, this is the most effective way to destroy the unhatched locusts.

It may be well to remind owners and occupiers of land of the necessity of notifying an Inspecting Officer, or the nearest Land Office or Police Office, of the presence of locusts on their land, as laid down in Section 13 of "The Agricultural Pests Enactment, 1913." European planters generally have given the Special Assistants every facility for dealing with hoppers on their estates, but there are a few who have apparently overlooked the Section mentioned, and who have not yet awaked to the fact that the locusts in this country are a serious menace which calls for public spirited action. Only by hearty co-operation on the part of all the planting community will it ever be possible to make a complete success of the present locust campaign.

A new generation of hoppers is to be expected shortly in Selangor. It will probably facilitate the location of swarms on estates where otherwise they might go unrecorded for some considerable time after hatching, if Managers will make it known among their mandores and coolies that rewards will be paid them for the first report of any breeding ground or swarm of hoppers. The scale of rewards now in operation is as follows:—

For reporting a breeding ground	$10.00
,, ,, swarm of first instar hoppers ... (No brown markings on cheeks or body)	5.00
,, ,, swarm of 2nd to 5th instar ... (Cheeks or body show brown or yellow markings)	2.00

Summary of Locust Destruction, Negri Sembilan, October, 1913.

District	Special Assistant	Swarms	Kerosene Tins
Seremban	Wolde	8	22
Coast	Tollemache	44	85
Tampin and Kuala Pilah		19	186
	Total	71	293
	November, 1913.		
Seremban	Wolde	116	330
Coast	Tollemache	170	346
Kuala Pilah and Tampin	Peche	49	891
Kampong Batu	Keane	27	179
		362	1,836

Preliminary General Circular.

ASSOCIATION SCIENTIFIQUE INTERNATIONALE D'AGRONOMIE COLONIALE ET TROPICALE.

THIRD INTERNATIONAL CONGRESS OF TROPICAL AGRICULTURE, LONDON, 1914.

Preliminary Notice.

The International Association for Tropical Agriculture (Association scientifique internationale d'Agronomie coloniale et tropicale) has decided to hold in London, in June, 1914, an International Congress, in which all countries interested in Tropical Agriculture and Forestry are invited to participate. The Association has requested the Committee of the British Section, whose headquarters are at the Imperial Institute, to make the necessary arrangements for the meeting, in co-operation with the Bureau of the International Association in Paris.

The Congress will be held at the Imperial Institute, South Kensington, London, S.W. It will open on Tuesday, June 23rd, and close on Tuesday, June 30th, 1914.

Order of Business.

In the order of business at the Meeting, the morning sittings (10 a.m. to 1 p.m.) will be reserved for papers and discussions on subjects of general importance, each morning being devoted to a single subject; the afternoon sittings (3 to 5 p.m.) will be reserved for papers and discussions on special subjects.

Transactions.

Communications intended for the Congress may be made in English, French, German or Italian; but the general language of the Congress will be English.

The following subjects are suggested for papers and discussion at the morning meetings. Contributions on these and similar subjects are invited :—

I. Technical Education and Research in Tropical Agriculture.
II. Labour Organisation and Supply in Tropical Countries.
III. Scientific Problems of Rubber Production.
IV. Methods of developing Cotton Cultivation in New Countries.
V. Problems of Fibre Production.
VI. Agricultural Credit Banks.
VII. Agriculture in Arid Regions.
VIII. Problems in Tropical Hygiene and Preventive Medicine.

Papers for the afternoon meetings are invited on the following subjects :—

I. Problems relating to Tropical Agriculture and Forestry.
II. The Cultivation and Production of—

Rubber.	Tea.
Cotton and Fibres.	Coconuts.
Cereals and other Foodstuffs.	Other Agricultural Products.
Tobacco.	Forest Products.

III. Plant Diseases and Pests affecting Tropical Agriculture.

Papers recommended for publication and Reports of Discussions will be published at the close of the Congress.

Subscription.

The subscription for membership of the Congress will be £1, entitling members to admission to all meetings and receptions and to receive the volume of printed papers and discussions, on publication. Those desiring to become members of the Congress are requested to fill in an enclosed form and return it to the Organising Secretaries for the Congress, as soon as conveniently possible, in order that their names and permanent addresses may be registered.

Notices.

A General Programme, with the complete arrangements, will be forwarded to all registered members before the Meeting.

Arrangements will be made for the accommodation of members of the Congress at suitable hotels.

Arrangements have been made by the Organisers of the International Rubber Exhibition and of the International Cotton, Fibres, and Allied Industries Exhibition to hold these Exhibitions during the period of the Congress, at the Royal Agricultural Hall, Islington, London, N. Members of the Congress will receive free Season

tickets of admission to the Exhibitions; and special means of conveyance between the Imperial Institute and the Agricultural Hall will be provided.

The Organising Committee cordially invite all who take an interest in Tropical Agriculture and Forestry to attend the Congress and to make the contents of the present circular as widely known as possible.

All correspondence relating to the communication of papers and the arrangements for the Congress should be addressed to :—

The Organising Secretaries,

Third International Congress of Tropical Agriculture,
Imperial Institute,
London, S.W.

WYNDHAM R. DUNSTAN,
President of the International Association & Chairman of the Organising Committee for the Congress in London.

F. HEIM,
Secrétaire Perpétuel de l'Association Internationale, Paris.

T. A. HENRY, H. BROWN. } *Honorary Organising Secretaries of the Congress in London.*

To the Organising Secretaries of the Third International Congress of Tropical Agriculture, Imperial Institute, London, S.W.

I desire to become a member of the Third International Congress of Tropical Agriculture, to be held in London in June, 1914; and I enclose* .....
for £1 (One Pound) in payment of my subscription.

It is my intention to be present at the Congress.

*Cheques to be crossed and made payable to the Secretaries, Congress of Tropical Agriculture.

Please write distinctly—

Full name .....

Title or designation .....

.....

Address to which all communications should be sent:

.....

.....

.....

(Name and address should be given in the form in which it is desired that these should appear in the official publications of the Congress).

Date ....., *191* .

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M. le Prof. de Monte-Pereira, ancien Directeur au Ministère des Colonies, à Lisbonne,

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Dr. F. Watts, C.M.G., Imperial Commissioner of Agriculture for the West Indies.

Dr. T. A. Henry, Imperial Institute, London, } Honorary
Mr. Harold Brown, Imperial Institute, London, } Secretaries.

THE GARDENS' BULLETIN.

We are pleased to note the appearance of the first issue under this name of the *Gardens' Bulletin of the Straits Settlements*. For the sake of convenience, this number is taken as No 6 of a volume which includes the five parts published of the unfinished volume of the *Agricultural Bulletin, S S. and F.M.S.*

It is not proposed to issue the *Gardens' Bulletin* regularly, but it will appear from time to time as material becomes available, and the Editor promises that more original matter will be provided than formerly, a promise that the present number well bears out.

The *Gardens' Bulletin* is intended to continue the scientific and economic botanical side of the old *Agricultural Bulletin, S.S. and F.M.S.*, as the *Agricultural Bulletin, F.M.S.*, does its scientific and practical agricultural side.

Of interest particularly to planters in the present issue is the article on the Coconut Beetles, *Oryctes rhinoceros* and *Rhyncophorus ferrugineus*. It describes and explains the spread of these beetles, their habits and methods of dealing with them as studied and worked out in Samoa, German East Africa, Ceylon, India and Malaya. The principal means of control, of course, is the destruction of all accumulations of vegetable refuse in which the beetles breed. A trap used in Samoa and which might be of use on estates, if properly looked after, is also described.

The price lists of ornamental and economic plants which can be obtained at the Singapore Botanic Gardens will be of interest to all who wish to add to their collections.

FEDERATED MALAY STATES.

Comparative Statement of Cultivated Rubber Exported, with Value and Duty Collected Thereon, during the Years 1913 and 1912.

Destination.	Exported during Nov. 1913.	Previously.	Total export during the year.	Export during similar period of previous year.	Increase.	Decrease	Value of rubber exported, 1913.	Duty collected, 1913, to date.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	$	$ c.
Straits Settlements ...	1,169.70	8,544.99	9,714.69	5,773.45	3,941.24	...	23,780,901	590,043.86
United Kingdom ...	746.79	8,620 63	9,367.42	6,771.65	2,595.77	...	23,856,103	596,402.50
Continent of Europe ...	95.36	1,125.01	1,220.37	939.51	280.86	...	3,131,970	78,299 25
Ceylon	49.75	497.80	547.55	354.97	192.58	...	1,413,302	35,332.50
Other Countries ...	...	...	...	10.45	...	10.45	...	...
Total ...	2,061.60	18,788 43	20,850.03	13,850 03	7,010.45	10.45	52,182,276	1,300,078.11

KUALA LUMPUR,
5th December, 1913.

W. J. P. HUME,
Commissioner, Trade and Customs, F.M.S.

Abstract of Meteorological Readings in the various Districts of Malaya for the Month of November, 1913.

DISTRICT.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	TEMPERATURE.				HYGROMETER.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
Kelantan, Kota Bahru	...	147.	79.1	83.90	70.93	12.97	76.4	.854	74.5	.86%	...	28.56	5.20
Malacca, Durian Daun Hos.	29.912	144.8	81.	85.3	71.7	13.6	78.5	.935	...	.89	N. W.	10.28	1.79
N. Sembilan, Dist. Hospital Seremban	...	148.5	77.8	88.7	71.4	17.3	75.4	.834	73.7	.87	N. W.	15.89	1.80
„ Dist. Hos. K. Pilah	...	154.8	79.4	86.6	73.6	13.	77.6	.908	76.3	.90	...	16.11	2.86
„ „ Tampin	...	151.	78.9	...	...	...	75.6	.825	73.4	.83	...	14.73	2.58
„ „ P. Dickson	...	155.6	80.4	86.6	73.6	13.	76.9	.856	74.5	.82	...	11.98	2.30
Pahang, „ K. Lipis	...	...	79.4	88.6	67.6	21.	75.4	...	...	...	...	11.63	3.00
Penang, „ Penang	29.847	144.5	80.9	87.5	72.7	14.8	77.1	.850	73.3	82.6	...	18.56	3.21
Perak, „ Taiping	...	104.	79.85	91.	70.	21.	76.5	.849	...	.85	...	32.16	3.76
„ „ Ipoh	...	...	79.96	90.	69.	21.	75.97	.843	...	.84	...	21.43	2.85
„ „ T. Anson	...	...	80.45	90.	71.	19.	77.05	.885	...	.87	...	16.70	2.12
„ „ P. Buntar	...	...	79.72	89.	71.	18.	76.14	.855	...	.85	...	17.35	2.58
„ The Cottage	...	...	...	...	...	...	...	...	...	...	...	38.45	5.85
Selangor, General Hospital Kuala Lumpur	...	118.4	79.9	89.3	77.2	12.1	76.9	.864	74.7	.84	S. E.	12.79	2.72
„ Dist. Hos. Klang	...	...	78.8	85.	72.3	12.7	75.7	...	...	...	...	14.36	1.65
„ „ K. Selangor	...	...	...	86.7	74.5	12.2	...	...	...	...	...	9.98	1.65
„ „ Rawang	...	...	...	91.	71.8	19.2	...	...	...	...	...	11.81	1.66
Singapore, Kandang Kerbau Observatory	29.902	160.4	81.3	91.2	71.	20.2	77.4	.883	...	.83	.S W.	16.37	3.13